REASEARCH MISCONDUCT IN THE UNITED STATES DURING THE PAST DECADE

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Abstract

This research was designed to investigate patterns of research misconduct across institutions in the United States in the past decade. Certain factors such as type of institution, size of the institution, funding of institution, number of publications, year of retraction, research administration structure, and occurrence rates were explored. The retraction database, National Institutes of Health (NIH), Office of Research Integrity (ORI), and individual institution websites provided access to information and or data on 336 retracted articles during the past decade. The publically available data was analyzed using standard statistical methods. The analysis of data supports that on average it takes 5.8 years for articles involved in research misconduct to be retracted. 2015 had the highest number of retracted articles (74) while 2011 had the lowest (6). 85% of research misconduct related retracted articles are from universities. The NIH had the most repeated research misconduct cases, having multiple retracted articles across various years (2009, 2014, 2015, 2016, 2017, 2018). Out of 81 institutions, 38 (47%) had repeat offenses for at least 1+ year of research misconduct cases. The study provided evidence that there is a relationship between the amount of funding and the number of retracted articles. The relationship is negative meaning that the probability of having an article retracted is greater for smaller funded programs than higher funded programs. Throughout the decade there has been an increase trend of retracted articles due to falsification / fabrication of data within the United States.

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Chapter 1

Introduction

Background

What is research misconduct?

The National Institutes of Health (NIH) and the Office of Research Integrity (ORI) defines research misconduct as: "fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.

(a) Fabrication is making up data or results and recording or reporting them.

(b) Falsification is manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.

(c) Plagiarism is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit.

(d) Research misconduct does not include honest error or differences of opinion.

Misconduct must be an intentional or reckless departure from accepted practices of the relevant research community" (NIH, 2019).

Types of research misconduct:

There are various classifications of research misconduct that can occur throughout the research process such as misappropriation of ideas, plagiarism, impropriety of authorship, failure to comply with legislative and regulatory requirements, violation of generally accepted research practices, and falsification of data. This study focuses on falsification and fabrication of data during publications of research.

The following table illustrates all the reasons why articles can be retracted due to research misconduct:

Breach of Policy by Author	A violation of the journal, publisher or institutional accepted practices by the author.
Breach of Policy by Third Party	A violation of the journal, publisher or institutional accepted practices by a person or company/institution not the authors.
Civil Proceedings	Non-criminal litigation arising from the publication of the original article or the related notice(s).
Complaints about Author	Allegations made strictly about the author without respect to the original article.
Complaints about Company/Institution	Allegations made strictly about the author's affiliation(s) without respect to the original article.
Complaints about Third Party	Allegations made strictly about those not the author or the author's affiliation(s) without respect to the original article.
Concerns/Issues About Authorship	Any question, controversy or dispute over the rightful claim to authorship, excluding forged authorship.
Concerns/Issues About Data	Any question, controversy or dispute over the validity of the data.
Concerns/Issues About Image	Any question, controversy or dispute over the validity of the image.
Concerns/Issues about Referencing/Attributions	Any question, controversy or dispute over whether ideas, analyses, text or data are properly credited to the originator.
Concerns/Issues About Results	Any question, controversy or dispute over the validity of the results.
Concerns/Issues about Third Party Involvement	Any question, controversy or dispute over the rightful claim to authorship, excluding forged authorship.
Conflict of Interest	Authors having affiliations with companies, associations, or institutions that may serve to influence their belief about their findings.
Criminal Proceedings	Court actions that may result in incarceration or fines arising from the publication of the original article or the related notice(s).
Duplication of Article	Also known as "self-plagiarism". Used when an entire published item, or undefined sections of it, written by one or all authors of the original article, are repeated in the original article without appropriate citation.
Duplication of Data	Also known as "self-plagiarism". Used when all or part of the data from an item written by one or all authors of the original article, are repeated in the original article without appropriate citation.

Duplication of Image	Also known as "self-plagiarism". Used when an image from an item written by one or all authors of the original article is repeated in the original article without appropriate citation.
Duplication of Text	Also known as "self-plagiarism". Used when sections of text from an item written by one or all authors of the original article, are repeated in the original article without appropriate citation.
Ethical Violations by Author	When an author performs an action contrary to accepted standards of behavior. Generally used only when stated as such in the notice and no other specific reason (e.g., duplication of image) is given.
Ethical Violations by Third Party	When any person not an author performs an action contrary to accepted standards of behavior. Generally used only when stated as such in the notice and no other specific reason (e.g., duplication of image) is given.
Euphemisms for Duplication	The notice does not clearly state that the authors reused ideas, text, or images from one of their previously published items without suitable citation.
Euphemisms for Misconduct	The notice does not clearly state that the reason for the notice is due to fabrication, falsification, or plagiarism by one or all the authors, despite an institutional report stating such.
Euphemisms for Plagiarism	The notice does not clearly state that the authors reused ideas, text, or images, without suitable citation, from items published by those not the authors.
Fake Peer Review	The peer review was intentionally not performed in accordance with the journal's guidelines or ethical standards.
Falsification/Fabrication of Data	Intentional changes to data so that it is not representative of the actual finding.
Falsification/Fabrication of Image	Intentional changes to an image so that it is not representative of the actual data.
Falsification/Fabrication of Results	Intentional changes to results so that it is not representative of the actual finding.
Forged Authorship	The fraudulent use of an author's name in submitting a manuscript for publication.
Hoax Paper	Paper intentionally drafted with fraudulent data or information with the specific intent of testing a journal's or publisher's manuscript acceptance policies.
Informed/Patient Consent – None/Withdrawn	When the full risks and benefits from being in an experiment are not provided to and accepted by the participant, or the participant chooses to later recant their approval.

Investigation by Company/Institution	An evaluation of allegations by the affiliations of one or all of the authors.
Investigation by Journal/Publisher	An evaluation of allegations by the journal or publisher.
Investigation by ORI	An evaluation of allegations by the United State Office of Research Integrity.
Investigation by Third Party	An evaluation of allegations by a person, company or institution not the Authors, Journal, Publisher or ORI.
Lack of Approval from Author	Failure to obtain agreement from original author(s).
Lack of Approval from Company/Institution	Failure to obtain agreement from original author(s).
Lack of Approval from Third Party	Failure to obtain agreement from original author(s).
Lack Of Balance/Bias Issues	Failure to maintain objectivity in the presentation or analysis of information.
Lack of IRB/IACUC Approval	Failure to obtain consent from the institutional ethical review board overseeing human or animal experimentation.
Legal Reasons/Legal Threats	Actions taken to avoid or foster litigation.
Manipulation of Images	The changing of the presentation of an image by reversal, rotation or similar action.
Manipulation of Results	The changing of the presentation of results which may lead to conclusions not otherwise warranted.
Misconduct – Official Investigation/Finding	Finding of misconduct after investigation by incorporated company, institution of governmental agency.
Misconduct by Author	Statement by journal, publisher, company, institution, governmental agency, or author that author committed misconduct.
Misconduct by Company/Institution	Statement by journal, publisher, company, institution, or governmental agency that company/institution committed misconduct.
Misconduct by Third Party	Statement by journal, publisher, company, institution, or governmental agency that a third party committed misconduct.
Objections by Author(s)	A complaint by any of the original authors or refusal to agree on actions taken by the journal or publisher.

Objections by Company/Institution	A complaint by any of the original authors' affiliation(s) or refusal by same to agree on actions taken by the journal or publisher.
Objections by Third Party	A complaint by any person, company or institution not of the original authors, or refusal by same to agree on actions taken by the journal or publisher.
Plagiarism of Article	Used when an entire published item, or undefined sections of it, and not written by one or all authors of the original article, are repeated in the original article without appropriate citation.
Plagiarism of Data	Used when the all or part of the data from an item not written by one or all authors of the original article, are repeated in the original article without appropriate citation.
Plagiarism of Image	Used when an image from an item not written by one or all authors of the original article is repeated in the original article without appropriate citation.
Plagiarism of Text	Used when sections of text from an item not written by one or all authors of the original article, are repeated in the original article without appropriate citation.
Publishing Ban	A Journal or Publisher states that no manuscripts will be acceptance from one or all the authors of the original article. It can be for a limited time, or indefinitely.
Results Not Reproducible	Experiments conducted, using the same materials and methods, that fail to replicate the finding of the original article.
Retract and Replace	The permanent change of an item to a non-citable status, with a subsequent republication by the same journal after substantial changes to the item.
Sabotage of Materials	An intentional action to surreptitiously change or contaminate experimental ingredients in order to artificially change the experimental outcome.
Sabotage of Methods	An intentional action to surreptitiously change or contaminate experimental instruments or tools in order to artificially change the experimental outcome.
Salami Slicing	The publication of several articles by using the same (small) dataset, but by breaking it into sections, with the intent of exploiting a limited data set for the production of several published works. This does not apply to large multi-group studies.
Unreliable Data	The accuracy or validity of the data is questionable.
Unreliable Image	The accuracy or validity of the image is questionable.
Unreliable Results	The accuracy or validity of the results is questionable.

Table 1- Summary of reasons for article retraction
(Retraction Watch Database, n.d.)

History of research misconduct:

The history of research has had its positive and negative effects; while much advancement has been made, the way studies have been conducted has not always been ethically correct. For instance, there are cases like, Dong-Pyou Han, a former biomedical scientist at Iowa State University, who admitted to falsifying the results of several vaccine experiments, Eric Poehlman, an expert on aging and obesity at the University of Vermont, who became the first American scientist sentenced to jail for research misconduct not involving fatalities, and Scott Reuben, a prominent Massachusetts anesthesiologist and researcher, who was found to have faked data in at least 21 studies (Nutt, 2016). Unfortunately, there have been other cases that are part of research's history of disreputable studies. Such trials caused a negative public stigma around the execution of research that has directly impacted scientific innovation to the present day. Over time there has been a great shift to properly govern research, however, skepticism still exists.

Beginning in the 1970s and 1980s, research misconduct was brought to the public's attention and Congressional scrutiny, which led to public statements, policies, and formal federal regulations by Government agency officials. The Office of Research Integrity (ORI) in the Department of Health and Human Services was a major component of this process. (Price, 2013)

What laws are in place?

In 1985, Congress took action by passing the Health Research Extension Act. It was added to Section 493 of the Public Health Service (PHS) Act, which required the Secretary of Health and Human Services to issue a regulation requiring applicant or awardee institutions to establish, "an administrative process to review reports of scientific fraud," and, "report to the Secretary any investigation of alleged scientific fraud, which appears substantial." The Section also required the NIH Director to start a process for receiving and responding to reports from institutions. In 1986, the NIH published guidelines

in the NIH Guide for Grants and Contracts. The Final Rule, "Responsibilities of Awardee and Applicant Institutions for Dealing With and Reporting Possible Misconduct in Science," was published in the Federal Register on August 8, 1989 and codified as 42 CFR Part 50, Subpart A. In June 1993, the process of removing responsibility for handling allegations of research misconduct from the funding agencies was completed when President Clinton signed the NIH Revitalization Act of 1993. This Act established the ORI as an independent entity within Health and Human Services (HHS) and replaced the term, "scientific misconduct" with, "research misconduct" (ORI, n.d.). The HHS adopted the proposed government wide definition of research misconduct developed by the National Science and Technology Council that was published in the Federal Register on October 13, 1999. The Federal Research Misconduct Policy containing the final definition was published in the Federal Register on December 6, 2000 (U.S. Department of Health, n.d.). Currently, research misconduct is not considered a criminal offense; however, there have been numerous discussions on its criminalization in bioethical literature.

Underlying factors

There are several possible explanations for why research misconduct may occur. It is challenging to identify what the underlying causes of research misconduct are. Is it due to lack of knowledge, training, and resources? Or is it due to culture, pressure, and lack of oversight or infrastructure with our institutions or governance? Is the institution more at fault or the individual researchers?

There is an enormous pressure to constantly publish as a researcher that can cause some to attempt to cut corners on how they conduct their research. There could be cases where the Principle Investigator does not oversee his or her research staff, or an institution is not providing the necessary resources to regulate the research being done, or that individuals involved do not conduct research rigorously or ethically.

Several complications come with identifying research misconduct. It is difficult to quantify the number of research misconduct cases that are reported and documented versus the cases that have never been reported. Having such cases in the public eye is detrimental to the entities involved, provoking them to often handle the cases in an undisclosed manner. Based on surveys conducted on researchers, there are much higher estimates of research misconduct than reported in the literature (National Academies of Science, 2017).

Programs

Each institution has established policies and types of programs for research misconduct. Additionally, these entities have specific means of auditing and evoking consequences. Most universities have similar policies while companies might have more diversity that is dependent on specific company policies. Researchers are required and expected to follow federal, state and institutional laws. University's Research Integrity Officers (RIO) is responsible for implementing policies on research misconduct. Institutions have research misconduct teachings, learning tools, and trainings. Furthermore, it is typical to have a specific committee, monitoring or office for regulation of misconduct.

The Association of American Universities (AAU), the Association of American Medical Colleges (AAMC), and other national organizations as well as government agencies have established a Committee on the Integrity of Research. They recognized a need for universities to collaborate with professional societies and related organizations in the examination of the sources of such problems and remedies available to them (National Research Council, 1989).

There are specific misconduct procedures depending on the case. Initially there is an investigation, and depending on the findings, papers can be retracted, an agreement can be settled, researchers could be terminated, and/or a trail can occur. Additionally, repeat offenses are handled on a

case-by-case basis. A more serious breach of research misconduct usually results in harsher disciplinary action. Institutions can find out about cases through various means such as the researchers involved, the subjects, researchers at a different institution, federal agencies, reviewers, or journal articles.

Chapter 2 Review of Literature

Literature review:

There have been specific studies that have investigated research misconduct throughout the years. One in particular examined the interval between publication and retraction for 2,047 retracted articles indexed in PubMed. Time-to-retraction (from publication of article to publication of retraction) averaged 32.91 months (2.74 years). Among 714 retracted articles published in or before 2002, retraction required 49.82 months; among 1,333 retracted articles published after 2002, retraction required 23.82 months ($p<0.0001$). This suggests that journals are retracting papers more quickly than in the past, although recent articles requiring retraction may not have been recognized yet. (Steen, 2013)

Another article explored the text of 291 articles originating from the United States that were published between 1992 and 2012 and were retracted for research misconduct. (Fang et al., 2012) Of the articles included in this analysis, 95.9% were retracted due to data falsification or fabrication, with the remainder involving other forms of serious misconduct such as publication without institutional review board (IRB) approval. (Stern, 2014)

An alternative study included data from 621 retracted studies in their analysis. This study reported that the number and rate of retractions have increased since 2010. The most common reasons for retraction are errors (148), plagiarism (142), duplicate publication (101), fraud/suspected fraud (98), and invalid peer review (93). The number of retracted articles from Open Access Journals (OAJs) has been steadily increasing. Misconduct was the primary reason for retraction. (Wang, 2019)

Retractions are rare compared to the number of publications; among all articles in the biomedical database, PubMed, no higher than 0.02% (Amos, 2014; Wager and Williams, 2011) or considerably lower (Cokol et al., 2007, 2008; Redman et al., 2008) were retracted. A comparison of numbers or rates

of retractions is cumbersome since existing studies employ different search strategies and sample limitations. Time lags contribute to these differences between studies as retractions take up to 35 months to be updated, (Decullier et al., 2014) so that the complete number of retractions for a given year might not be accessible until three years later. (Sociol, 2017)

One study found that between the years 2000-2015, 134 retraction notices were published. Although they account for 0.07% of all articles published (190,514 excluding supplements, corrections, retractions and commissioned content), the rate of retraction is rising. The largest proportion of notices was issued by the authors (47 articles, 35%). The majority of retractions were due to some form of misconduct (102 articles, 76%), that is, compromised peer review (44 articles, 33%), plagiarism (22 articles, 16%) and data falsification/fabrication (10 articles, 7%). (Moylen, 2016)

Many studies have investigated the number of retracted articles, the time it takes to retract articles, how much cost is involved in research misconduct, and the consequences that occur after such cases. However, there has not been any focus on whether higher versus lower funded institutions are more or less likely to have increased retracted articles. What types of research entities have high retracted articles due to falsification of data? What percentages of retracted articles come from the same institution and from repeat years? The following study will provide further insight on these questions.

Chapter 3 Problem Statement

Research Objectives

This thesis will explore research misconduct cases around the United States by searching what data is publicly available in the past decade (2009-2019). The types of organizations that have had misconduct cases (private versus public, hospitals, universities, companies), the likelihood of misconduct incidents repeating, the funding level that these organizations receive, and the retraction rate of articles will be explored. Additionally, the institution's infrastructure will be reviewed to see how the organization handles such cases and what programs are in place.

Chapter 4 Methodology

Publicly available information from various sources was used to organize data that will be informative on research misconduct in the past decade. The ORI (research misconduct cases), NIH (funding), Retracted Publications Database, Institution's sites (programs, trainings, policies), and Scopus (database of articles) were all sources weighed for analysis.

Data was pulled from the Retracted Publications Database including the retraction reasons, the institution involved, first author, additional authors, year of original paper publication, and retraction year. Specifically, the falsification of data in the United States between the years of 2009 – 2019 was the search criteria used for the database. NIH databases provided the amount of NIH funding during the article publication year, and Scopus supplied the number of total articles for each given institution during that same year. Statistical analysis was conducted on the types of institutions with retracted articles, the average time it takes for articles to be retracted, and funding versus articles retracted.

Anticipated results

It was anticipated that higher funding institutions would have an increased chance of publically known research misconduct cases. Additionally, it might be more likely that lower funded institutions will have more retracted articles. Public entities are more likely to have research misconduct cases than private. It is believed that retracted articles will decrease with time.

Chapter 5 Data Analysis

The ORI only provided information on 26 institutions for research misconduct between the years of 2009-2019, while this study determined there were 70 total intuitions containing research misconduct in this time frame.

Total ORI reported research misconduct case findings that are available publicly:

PI and institution	Year
William W. Cruikshank, Ph.D., Boston University School of Medicine	2019
Edward J. Fox, Ph.D., University of Washington	2019
Brandi M. Baughman, Ph.D., University of North Carolina at Chapel Hill	2018
Maria Cristina Miron Elqutub, University of Texas MD Anderson Cancer Center	2018
Rajendra Kadam, University of Colorado, Denver	2018
Christian Kreipke, Ph.D., Wayne State University	2018
Krishna Murthy, Ph.D., University of Alabama at Birmingham	2018
Bhagavathi Narayanan, Ph.D., New York University	2018
Uthra Rajamani, Ph.D., Cedars-Sinai Medical Center	2018
Venkata Sudheer Kumar Ramadugu, Ph.D., University of Michigan	2018
Srikanth Santhanam, Ph.D., Washington University in St. Louis	2018
Shiladitya Sen, The Ohio State University	2018
Colleen T. Skau, Ph.D., National Institutes of Health	2018
Rakesh Srivastava, Ph.D., University of Kansas Medical Center	2018
Li Wang, Ph.D., University of Connecticut	2018
Brandi M. Baughman, Ph.D., National Institutes of Health (NIH)	2017
Nasser Chegini, Ph.D., University of Florida	2017
Mahandranauth Chetram, Ph.D., Georgetown University and Emory School of Medicine	2017
Azza El-Remessy, Ph.D., University of Georgia, College of Pharmacy	2017
Matthew Endo, University of Illinois at Urbana-Champaign	2017

Alec Mirchandani, Florida Atlantic University	2017
Frank Sauer, Ph.D., University of California, Riverside	2017
Andrew R. Cullinane, Ph.D., National Institutes of Health	2016
Zhiyu Li Ph.D., Mount Sinai School of Medicine	2016
Ricky Malhotra, Ph.D., University of Michigan and University of Chicago	2016
John G. Pastorino, Ph.D., Rowan University School of Osteopathic Medicine	2016
Anil Potti, M.D., Duke University School of Medicine	2015
Eric J. Smart, Ph.D., University of Kentucky	2012
Mona Thiruchelvam, Ph.D., University of Medicine and Dentistry of New Jersey	2012

Table 2

Results

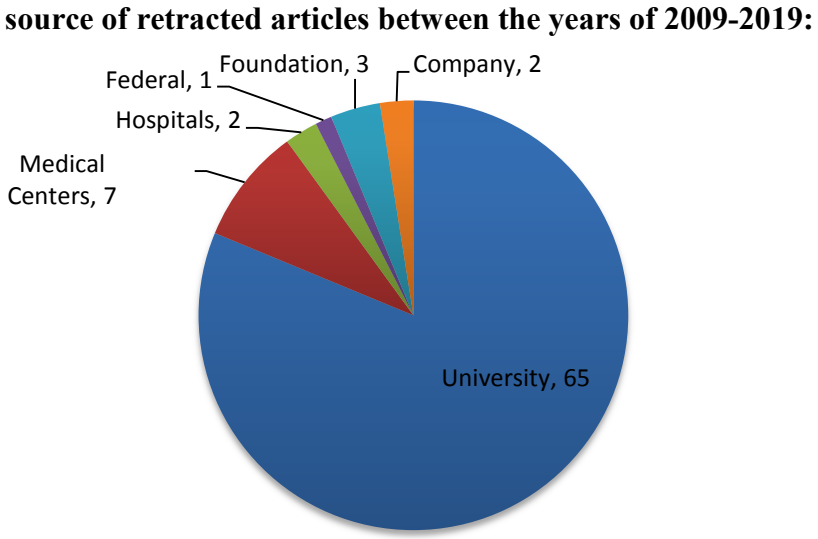

Figure 1

Additional reasons for retracted articles other than falsification of data:

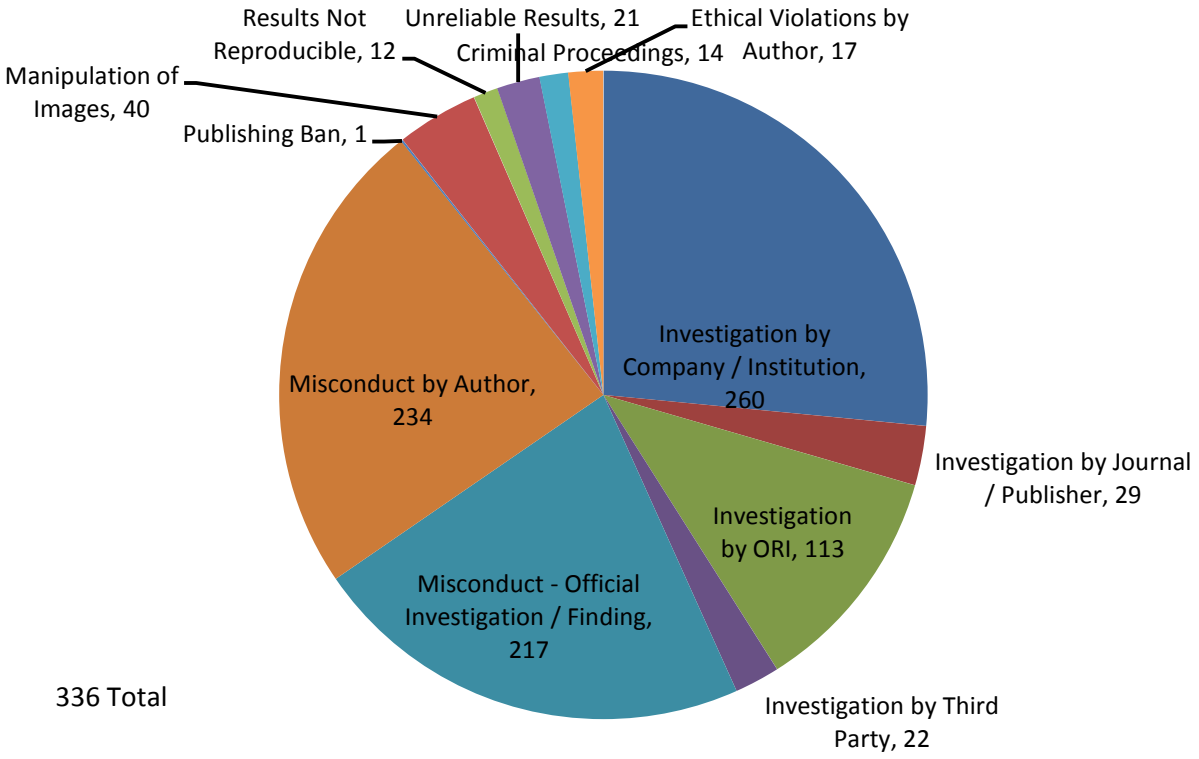

Figure 2

Total articles retracted by year:

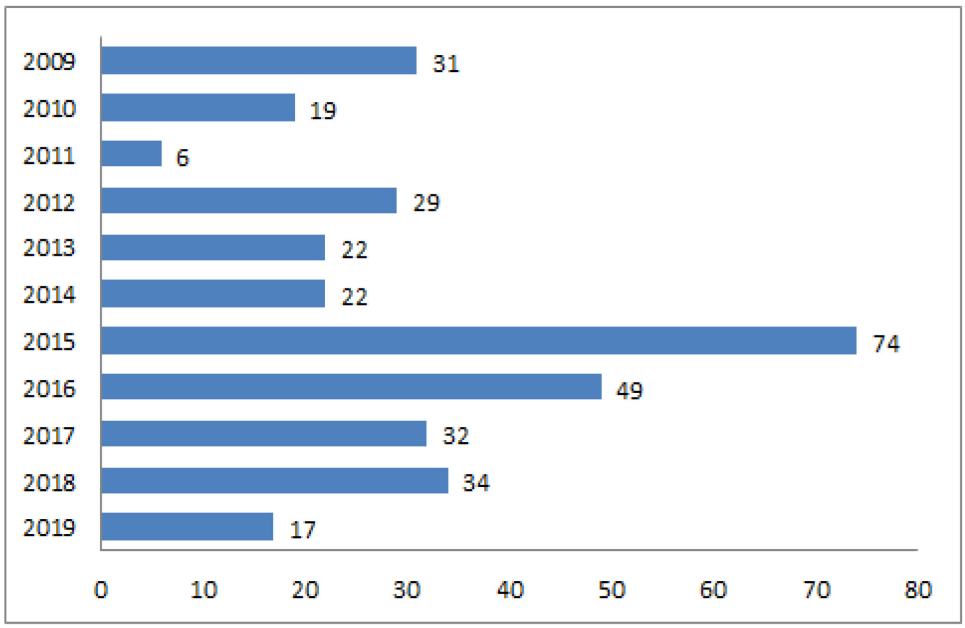

Figure 3

Average number of years it takes for an article to be retracted from the original publication year:

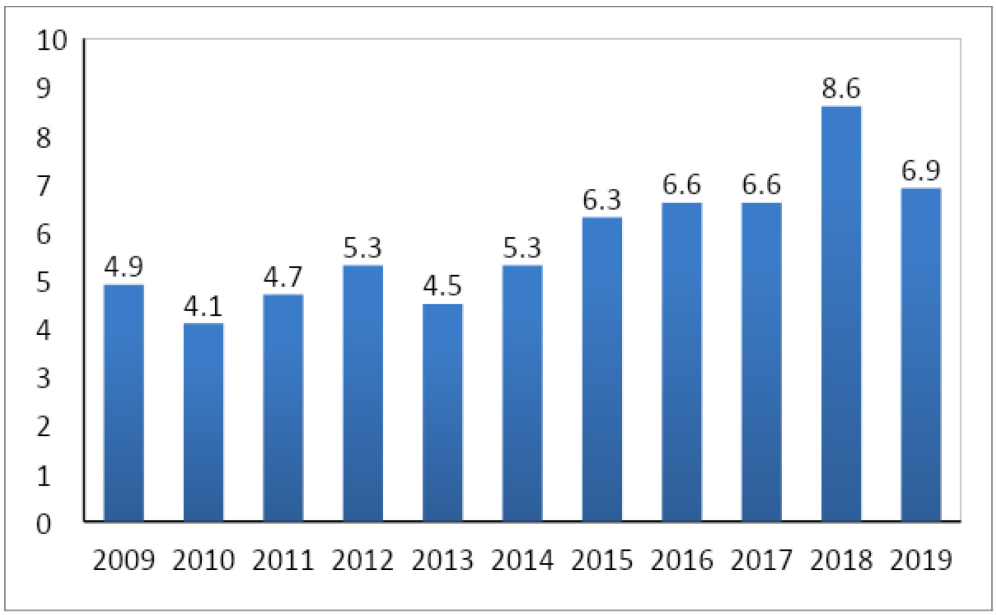

Figure 4

Total of published articles and NIH funding the year of article retraction by institution:

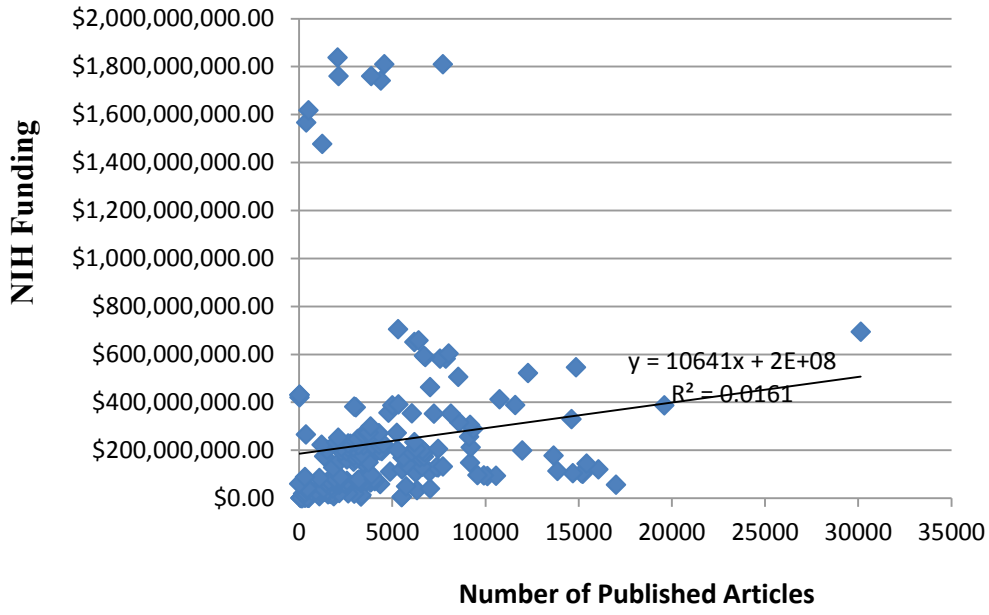

Figure 5

Total of retracted articles and NIH funding the year of the article publication by institutions:

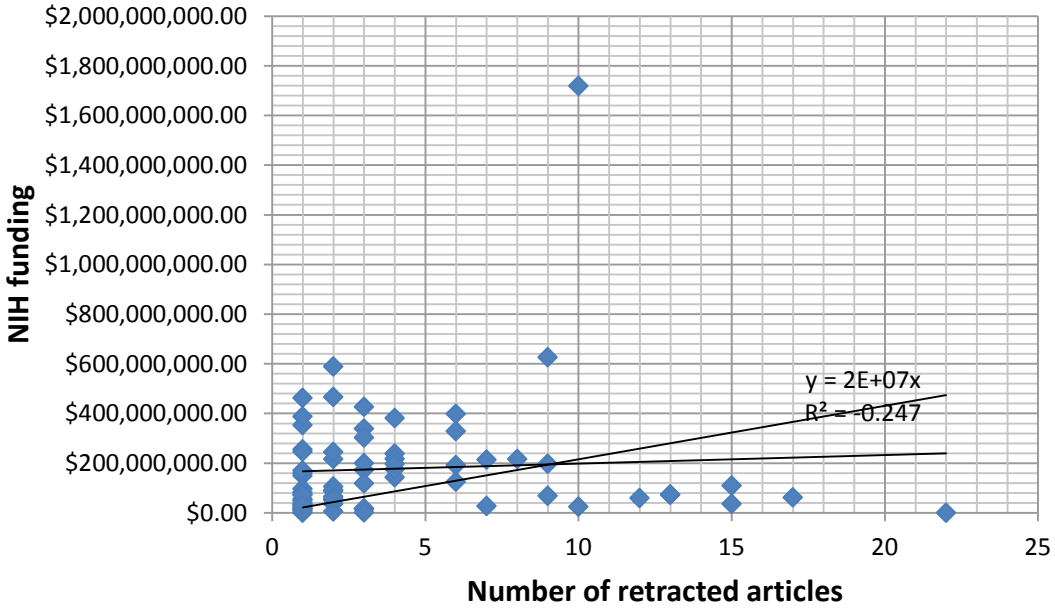

Figure 6

F- Test Total of retracted articles and NIH funding the year of the article publication by institutions:

	NIH Funding	*Retracted Articles*
Mean	1.81E+08	4.191176
Variance	5.78E+16	19.97783
Observations	68	68
df	67	67
F	2.89E+15	
P(F<=f) one-tail	0	
F Critical one-tail	1.498955	

Table 3

Chapter 6 Discussion of Data Results

The Office of Research Integrity only provided information on a select few research misconduct cases. The following statement is provided by ORI, "cases in which administrative actions were imposed due to findings of research misconduct are provided. The list only includes those who currently have an imposed administrative action against them. It does not include the names of individuals whose administrative actions periods have expired." (ORI, n.d.) The ORI should consider providing case information on all research misconduct without limitations in order to provide this information to the public and scientific community.

Most retracted articles due to fabrication of data were investigated by the institution / company (77%). While 33% involved the ORI, 9% the journal / publisher, and 6% a third party investigator. The number of retracted articles compared to the total number of published articles from each institution is a very small percentage (estimated .11%). 2015 had the greatest number of retracted articles, 74, compared to 2011 with 6. The data indicates that it takes an average of 5.8 years for articles to be retracted. 2018 had the highest retraction period of 8.6 years while 2010 was the lowest with an average of 4.1 years.

The NIH and universities had a higher likelihood of repeat offenses compared to the other entities. The NIH had the most repeat research misconduct cases across the years (2009, 2014, 2015, 2016, 2017, and 2018). Harvard University had 5 years of cases while University of California, Baylor College, University of Texas, University of Florida, and Bentley College each had 4 years. The range of funding of these institutions is varied. Out of 81 institutions, 38 (47%) had repeat offenses for at least 1+ years of research misconduct cases.

Furthermore, the study provided evidence that there is a relationship between the amount of funding and the number of retracted articles. The relationship is negative meaning that the probability of having an article retracted is greater for smaller funded programs compared to higher funded programs.

There are some signs that may point to an increased possibility of research misconduct. Are patterns due to chance or due to drawn awareness after an initial research misconduct case at a particular institution?

Similar to other datasets, there are limitations with this data. For instance, there are relatively few published studies, which are not freely comparable because of varying characterizations of research misconduct and the methods used for data collection. (Thiese, 2017) Total funding for all institutions is not readily available through public records. Institutions that do not receive NIH funding were not included. Additionally, research misconduct cases involving falsification / fabrication of data that never resulted in published and or retracted articles were not included. Data is not available on these cases.

Universities are more at risk for falsification of data; this difference could be due to a variety of unique factors compared to those that private entities encounter. It would be substantial to explore the infrastructure difference between universities and other entities in regards to number of retracted articles due to research misconduct issues. Are the research misconduct programs different between these entities? Is there more regulation or more pressure? Or do these cases tend to be more distinguishable in an exclusive sector?

Chapter 7 Conclusion

Over the past decade misconduct in research has attracted increasing attention from the press, the public, government, and the research community. This attention was initially drawn by a few highly publicized instances of data fabrication, plagiarism, and misrepresentation.

Federal amendments on the preservation of research data are expected to be enforced in every research establishment. Various agencies sole purpose is the conservation of research. And individual institutions have evident policies in place to protect their research. However research misconduct cases still continue to occur. There is a range of possible reasons for research misconduct: institutional failures of oversight, career and funding pressures, conflicts of interest, inadequate training, mentoring standards, and just social deviance patterns. It is essential to understand the balance between conflict of interest, code of conduct, and proper misconduct knowledge in order to ethically execute research.

Additional resources should be utilized to lessen the retraction time of misconduct articles. Taking an average of 5.8 years can cause irreversible damage. Besides, in that time many cases can be overlooked or not have sufficient information during investigation. The NIH and universities have higher cases of repeated years of retracted articles; this could be attributable to an overall higher production on publications as well as an increased pressure and competition to publish. Once an institution is exposed for misconduct the disclosure may heighten oversight causing supplemental retractions. It was originally predicted that higher funded organizations would have an extended probability of retracted articles due to elevated total publishing. However, the data displayed it was in fact lower funded institutions with higher probability of retracted articles. This trend may be due to fewer resources and oversight.

The responsibility of research misconduct does usually fall on the institution. Even though the percentage is low, the research community should work towards completely eliminating research

misconduct for safety and validity since research has suggested an increased tendency in retracted articles. Meticulous regulations on all accounts will ensure that neither code of ethics nor the validity of research is put in jeopardy. Organizations should form committees ensuring that data is being closely supervised. It is fundamental that all laws, regulations, and policies be addressed from the beginning and continue to be taught and enforced thoroughly. Research members should be well aware of all regulations and be held accountable for any major risks they put others in. Research administrators, institutions, universities, and companies need to cultivate together in order to regulate and sustain how research is completed across the nation. Representatives from various disciplines should agree upon which guidelines they should follow for quality record keeping. It must be clear what is expected and for it to be overseen by a committee regularly. Each project should have proper instructions on how all team members should be recording the data. It is vital to have members managing the oversight of the collection and recording of all data across different departments and entities. Administrators should establish that all associated researchers be trained in a united fashion and incorporate a well-defined individual to come to for any help due to confusion, questions, or concerns. Shared source documentation and databases need to be organized and implemented throughout. Having consistent supervision and monitoring will allow for fewer instances of research misconduct. Research administrators should hold frequent meetings to confirm everyone is on the same page and preforming all facets of the research correctly. Communication is key throughout such obscure projects; all employees should be comfortable to come to research administrators for all issues.

False data could be published without being reviewed causing individuals to be convinced by the findings reported, provoking possible injuries or even deaths. Research Integrity Officers are entrusted with the vigorous task to handle their institutions allegations of scientific misconduct. RIO's responsibilities include: interviewing respondents and complainants, requisitioning data, analyzing questioned data and documents; protect whistleblowers; and negotiating the regulatory environment

within research institutions and with federal oversight agencies. Members should not give in to outside pressures and should report any misconduct that is noticed. Monitoring should be constant across all funding entities. It is essential to produce the most reliable data and ensure all regulations are met for the sake of others and promotion of discoveries as a whole. The legitimacy of research needs to be of the highest level in order to instill a great quality of benefits to continue advancing society globally.

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Biographical Statement

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